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HITACHI

SJ100 series

VARIABLE FREQUENCY DRIVE

Sensorless Vector Control

Actual Size (SJ100-004NFE, 004NFU)

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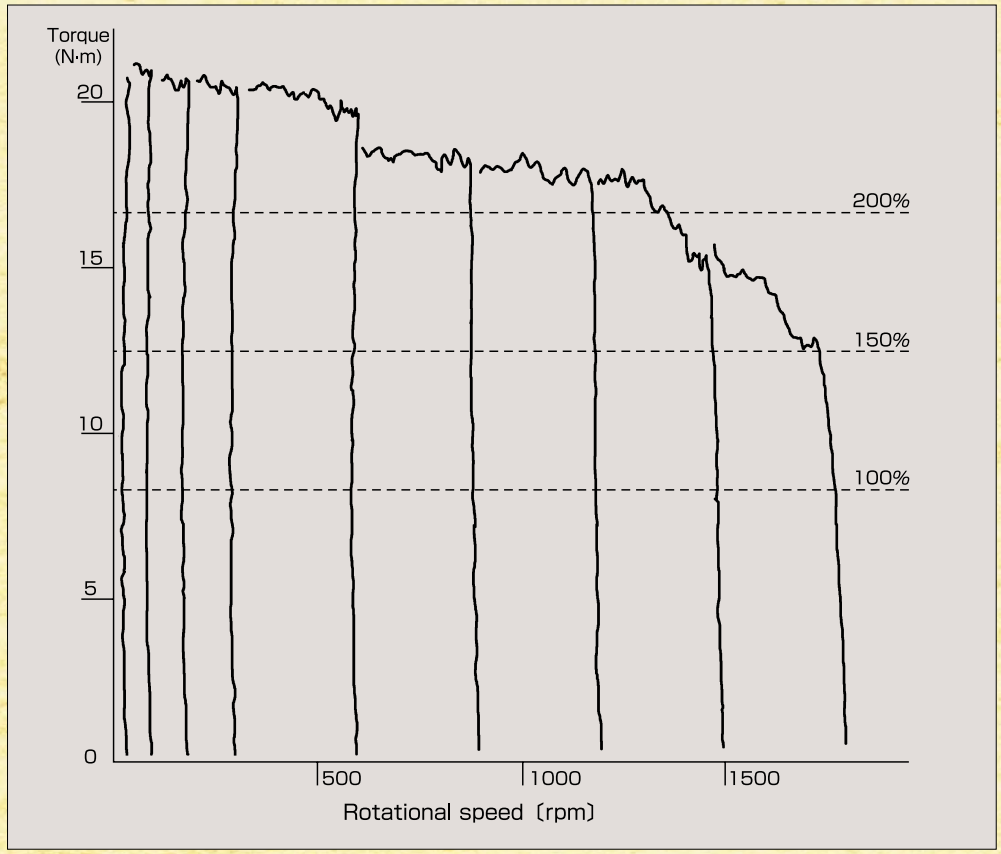
The small inverter with the power of a big one

Precise torque regulation using senseless vector control!

The torque calculation software (sensorless vector control) developed by Hitachi ensures accurate torque control throughout the entire frequency range, even with general purpose motors.

• High starting torque of 200%or more (3.7kW~ : 180% or more)

• 100% continuous operating torque within a 1:10 speed range (6 to 60 Hz/5 to 50 Hz) without motor de-rating. (3.7kW~: 1:3 (20~60Hz))



Example of SJ100-015NFE with Hitachi 1.5kW 4 pole totally enclosed type motor

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- Features ..... P1~4
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- Connection Diagram P15
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- For Correct Operation ..... P17~18

Advanced Functions Condensed in One Unit

- **Auto tuning to set motor constants**
- **Second motor setting (Provision to set second motor constants)**
- **PID control provided as standard**
- **16 –stage multispeed operation**
- **Instantaneous power failure retry (frequency stabilization)**
- **Intelligent terminal system allows you to select only the necessary functions from a full lineup of enhanced functions.**
- **FAN ON/OFF selection to provide longer cooling fan life**
- **Incorporated rush current prevention circuit**

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Compact, Powerful, Intelligent and Easy to Use

Perfect matching to Constant torque load

The powerful and intelligent SJ100 inverter series solves your applications requirements for high torque at low speeds.
[Dynamic braking circuit incorporated as standard]

- **CONVEYOR**
- **TRUCK**
- **EXTRUDER**
- **MIXER**
- **LIFT etc.**

Simple Operation By keypad or external input signals

The SJ100 can be started by pressing the RUN button or receiving an external signal through the terminal. Speed can be changed by standard potentiometer, keypad or external signals. Functions are grouped for quick, easy setting.

Compact Size Saves Space

Installation space is reduced by 56% from the J100 Series and 11% from the compact L50 Series. This allows downsizing of your system installation.

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Network-Compatible World Standard Machine Expands Global Business

The SJ100 Series of world standard machines provide global performance.

- **European low–voltage directive compliant, EMC directive compliant (with dedicated noise filter)**
- **UL, c–UL standards**
- **C–Tick (Australian EMC requirment, with dedicated noise filter)**

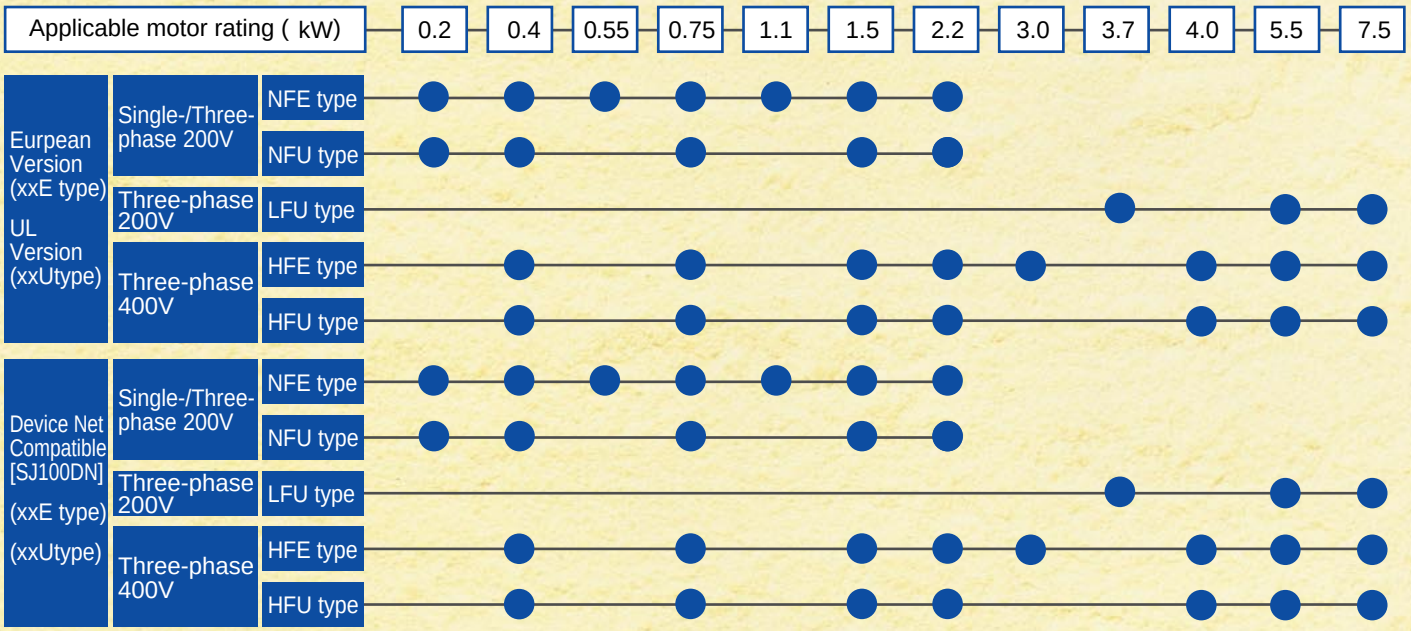
The line-up includes models compatible with DeviceNet.

<CE> <UL> <C–UL> <C–Tick>

■ Model Type List

SJ100 - 004 N F E

- SJ100: Series name
- 004: Applicable motor rating
  - 002 : 0.2kW
  - ⟆
  - 075 : 7.5kW
- N: Input power specification
  - L:Three-phase 200V class
  - N:Single-/three-phase 200V class
  - H:Three-phase 400V class
- F: F:Operator panel equipped
- E: E:European version for Europe, Australia, Singapore,etc.
  - U:UL version for North America



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Standard Specifications

Item			200 V Class										400 V Class							
Model (SJ100-)			002NFE 002NFU	004NFE 004NFU	005NFE —	007NFE 007NFU	011NFE —	015NFE 015NFU	022NFE 022NFU	— 037LFU	— 055LFU	— 075LFU	004HFE 004HFU	007HFE 007HFU	015HFE 015HFU	022HFE 022HFU	030HFE —	040HFE 040HFU	055HFE 055HFU	075HFE 075HFU
Protective structure:			IP20																	
Applicable motor(kW)			0.2	0.4	0.55	0.75	1.1	1.5	2.2	3.7	5.5	7.5	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5
Rated capacity(kVA)(240V/460V)			0.6	1.0	1.2	1.6	2.0	3.3	4.5	7.2	9.9	13.3	1.1	1.9	3.0	4.3	6.2	6.8	10.3	12.7
Rated input voltage			1-phase:200~240V +5%/-10%, 50/60Hz +/-5% 3-phase:200~230V+10%/-10%,50/60Hz+/-5% (037~075LFU :3-phase only)										3-phase380~460+/-10%,50/60Hz+/-5%							
Rated output voltage			3-phase 200~240V (corresponding to input voltage)										3-phase 380~460V (corresponding to input voltage)							
Rated output current (A)			1.6	2.6	3.0	4.0	5.0	8.0	11.0	17.5	24	32	1.5	2.5	3.8	5.5	7.8	8.6	13	16
Control method			Sine-wave pulse width modulation (PWM) control																	
Output frequency range *4			0.5 ~ 360 Hz																	
Frequency accuracy			Digital command: ± 0.01% of the Max. frequency Analog command: ± 0.1% (25℃±10℃) of the Max. frequency																	
Frequency setting resolution			Digital: 0.1 Hz, Analog: Max. frequency/1000																	
Volt./Freq. characteristic *5			V/F optionally variable, V/F control (constant torque, reduced torque), sensorless vector control																	
Overload current rating			150%, 60 seconds																	
Acceleration/deceleration time			0.1~3000 sec. (linear or S-curve acceleration/deceleration), second acceleration/deceleration setting available																	
Starting torque*6			200%or more							180%or more			200%or more						180%or more	
Braking	Dynamic braking *7 (without external resistor)		Approx. 100%				Approx.70%		Approx.20%				Approx. 100%		Approx. 70%			Approx.20%		
	Dynamic braking *7 (with external resistor)		Approx. 150%						Approx.100%		Approx.80%		Approx.150%			Approx.100%			Approx.80%	
	DC braking		Operating frequency, time, and braking force variable																	
Input signal	Frequency setting	Digital operator panel	Up ( ) and down ( ) keys/Value setting keys																	
		Potentiometer	Analog setting																	
		External signal *8	0~10 VDC (input impedance 10kΩ) 4~20mA (input impedance 250Ω), Potentiometer: 1kΩ to 2kΩ (2W) Variable resister																	
	Forward /Reverse run	Digital operator panel	Run/Stop (Forward/Reverse run change by command)																	
		External signal	Forward run/stop, Reverse run/stop Operation command available at terminal assignment (1a/1b selectable)																	
	Intelligent input terminal		FW (Forward run comand), RV (reverse run command), CF1~CF4 (multi-stage speed setting), JG (jogging command), 2CH (2-stage acceleration/deceleration command), FRS (free run stop command), EXT (external trip), USP (USP function), SFT (software lock), AT (analog current input select signal), RS (Reset), PTC (Thermal protection), DB(external DC braking command), SET(2nd setting selection), UP (remote control, acceleration), DWN (remote control, deceleration)																	
Output signal	Intelligent output terminal		RUN (running signal), FA1,2 (frequency arrival signal), OL (overload advance notice signal), OD (deviation signal at PID control), AL (alarm signal)																	
	Frequency monitor		PWM output; Select analog output frequency monitor, analog output current monitor or digital output frequency monitor																	
Alarm output contact			OFF for the inverter alarm (1C contact output) (possible to change to ON for the alarm)																	
Other functions			AVR function, curved acceleration/deceleration, upper and lower limiters, 16-stage speed, fine adjustment of start frequency, carrier frequency change (0.5to16Kz) frequency jump, gain and bias settung, process jogging, electronic thermal level adjustment, retry function, trip history monitor, 2nd setting selection, auto tuning, fan on/off selection																	
Protective function			Overcurrent, overvoltage, undervoltage, overload, extreme high temperature, CPU error, memory error, ground fault detection at startup, internal communication error,electronic thermal, CT error																	
Operating environment	Ambient/storage temperature/humidity		−10~50℃ (*9)/−25~70℃ (*10)/20~90% (no condensation)																	
	Vibration *11		5.9 m/s^2 (0.6G), 10~55 Hz																	
	Location		Altitude 1,000 m or less, indoors (no corrosive gases or dust)																	
Coating color			Munsell 8.5YR6.2/0.2,cooling fins in base color of aluminum																	
Option			Remote operator unit, copy unit, cables for the units, braking unit, braking resistor, AC reactor, DC reactor, noise filter																	
Weight(kg)			0.7	0.85	0.85	1.3	1.3	2.2	2.8	2.8	5.5	5.7	1.3	1.7	1.7	1.8	2.8	2.8	5.5	5.7

*1: The protection method conforms to JEM1030.
*2: The applicable motor refers to Hitachi standard 3-phase motor (4-pole). To use other motors, care must be taken to prevent the rated motor current from exceeding the rated output current of the inverter.
*3: The output voltage decreases as the main power supply voltage decreases. (Except for use of the AVR function)
*4: To operate the motor beyond 50/60 Hz, consult the motor manufacturer about the maximum allowable rotation speed.
*5: SLV selected, set carrier frequency more than 2.1kHz.
*6: At the rated voltage when using a Hitachi standard 3-phase, 4-pole moter.(When selecting high starting torque flux vector control)
*7: The braking torque at capacitive feedback is the average deceleration torque at the shortest deceleration (stoppage from 50 Hz) of the motor itself. It is not the continuous regenerative braking torque. And the average deceleration torque varies with motor loss. This value decreases when operating beyond 50/60 Hz. If a large regeneration torque is required, the optional braking resistor should be used.
*8: The frequency command is the maximum frequency at 9.8 V for input voltage 0 ~ 10 VDC, or at 19.6 mA for input current 4 ~ 20 mA. If this characteristic is not convenient, contact your Hitachi sales representative.
*9: To use the inverter at 40℃ or higher, reduce carrier frequency 2.1kHz and derate output current 80%, and remove the top cover.
*10: The storage temperature refers to the short-term temperature during transport.
*11: Conforms to the test method specified in JIS C0040 (1999). For the model types excluded in the standard specifications, contact your Hitachi sales representative.

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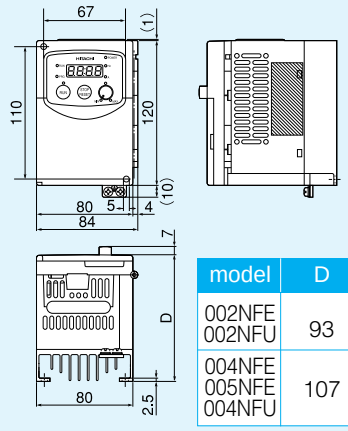
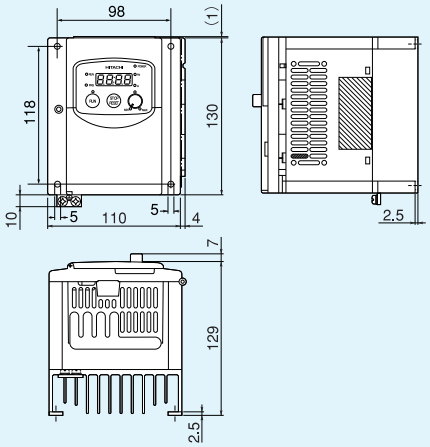
Dimensional Drawings

SJ100-002NFE, 004NFE, 005NFE 002NFU, 004NFU

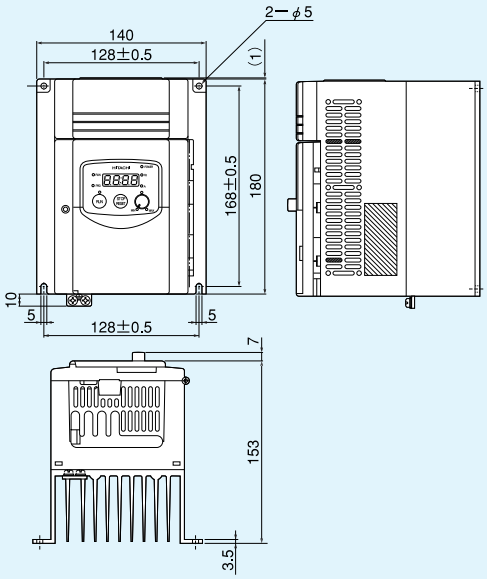


model	D
002NFE 002NFU	93
004NFE 005NFE 004NFU	107

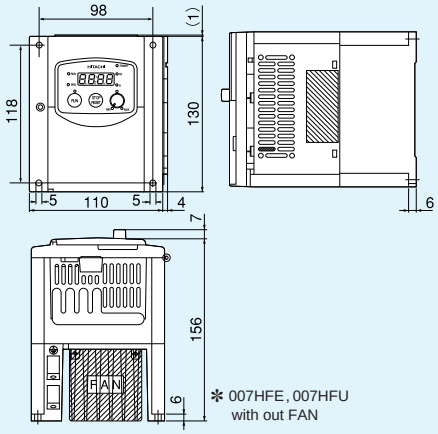
SJ100-007NFE, 011NFE, 004HFE 007NFU, 004HFU



SJ100- 015NFE, 015NFU

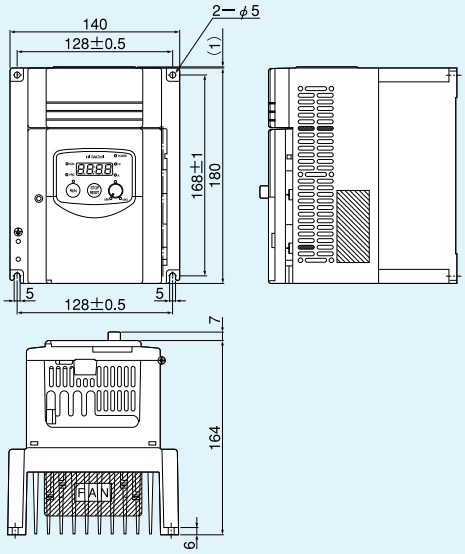


SJ100-007HFE, 015HFE, 022HFE 007HFU, 015HFU, 022HFU

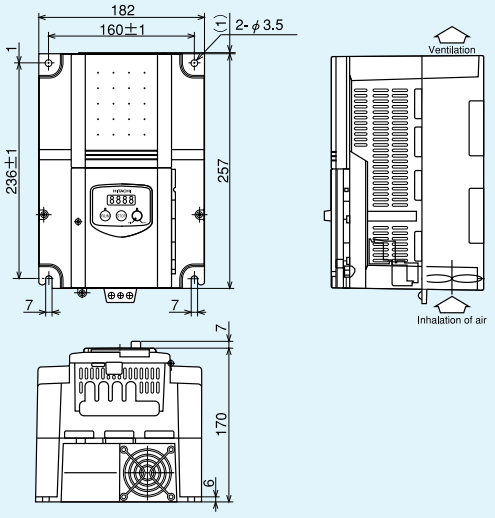


✻ 007HFE, 007HFU with out FAN

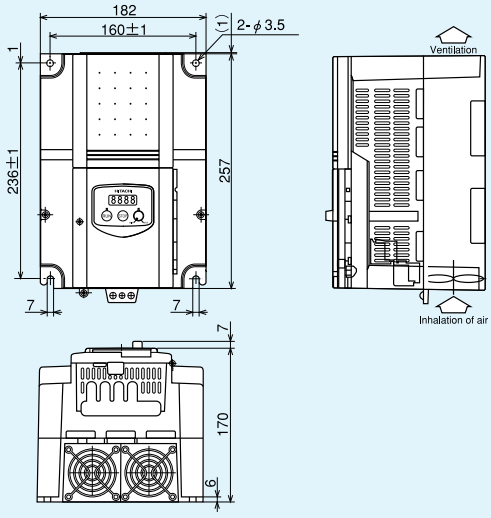
SJ100-022NFE, 030HFE, 040HFE 022NFU, 037LFU, 040HFU



SJ100-055LFU,055HFE,055HFU, 075HFE,075HFU



SJ100- 075LFU



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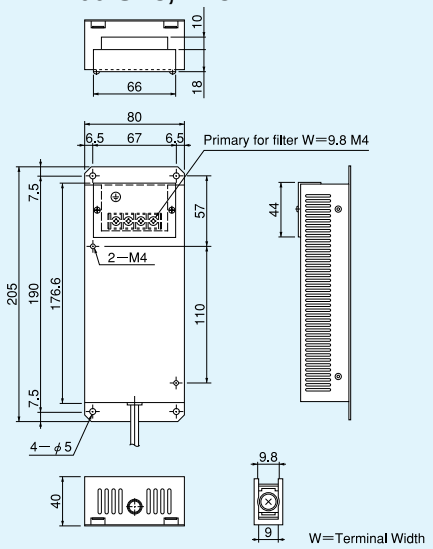
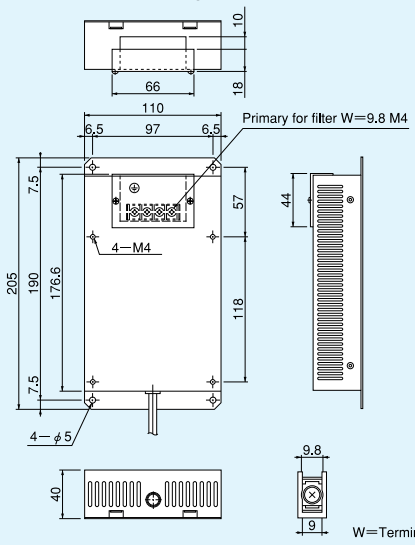
Dimensional Drawings

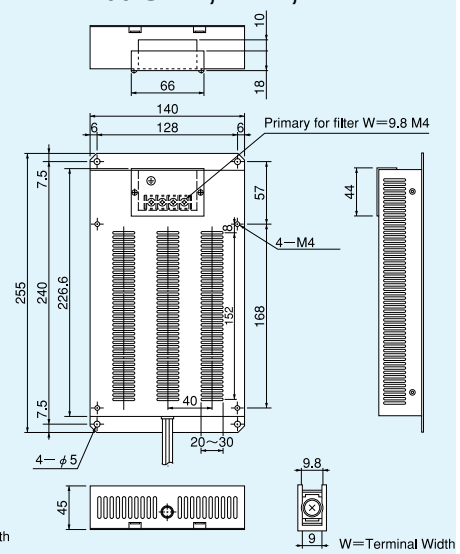
● FFL100-SB3, LB3



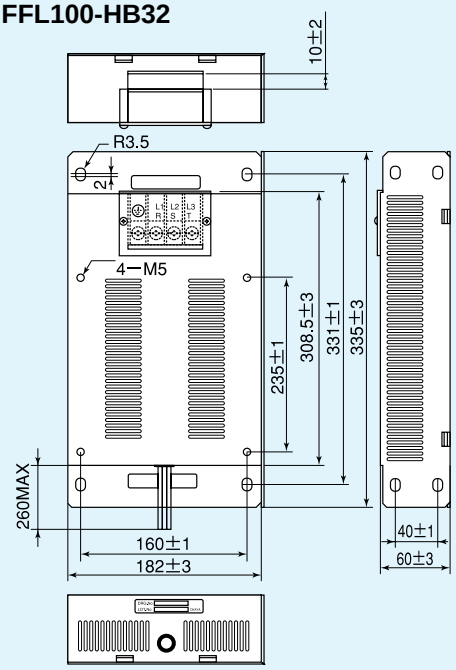
● FFL100-SB5, HB6



● FFL100-SB11, HB11, HB17



● FFL100-HB32



Noise filter

Inverter model	Input Power Source	Inverter model
SJ100-002NF★ 004NF★	1-phase 200V class	FFL100-SB3
	3-phase 200V class	FFL100-LB3
SJ100-005NFE 007NF★	1-phase 200V class	FFL100-SB5
	3-phase 200V class	FFL100-HB6
SJ100-011NFE 015NF★ 022NF★	1-phase 200V class	FFL100-SB11
	3-phase 200V class	FFL100-HB11
SJ100-037LFU	3-phase 200V class	FFL100-HB17
SJ100-055LFU 075LFU	3-phase 200V class	FFL100-HB32
SJ100-004HF★ 007HF★ 015HF★	3-phase 400V class	FFL100-HB6
SJ100-022HF★ 030HFE 040HF★	3-phase 400V class	FFL100-HB11
SJ100-055HF★ 075HF★	3-phase 400V class	FFL100-HB32

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Operation

The SJ100 Series can be easily operated with the digital operator panel equipped as standard in the main unit.
For remote operation, the remote operator unit is available as an option.

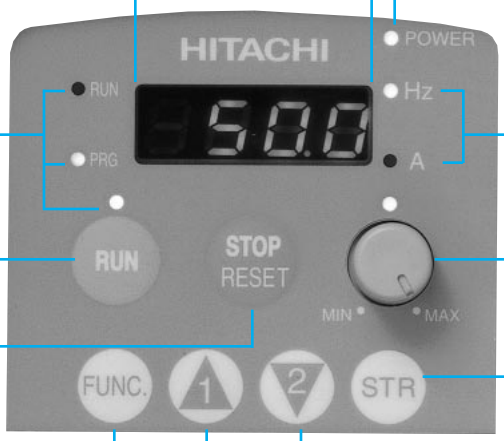
Monitor section (LED)
Displays the monitored frequency, motor current, motor rpm, or alarm condition.

Monitor lamp
Indicates the monitor item.

Run key
Press to start the motor.

Stop/Reset key
Press to stop the motor or to cancel the alarm.

Function key



Power lamp
Indicates ON/OFF of the control circuit power supply.

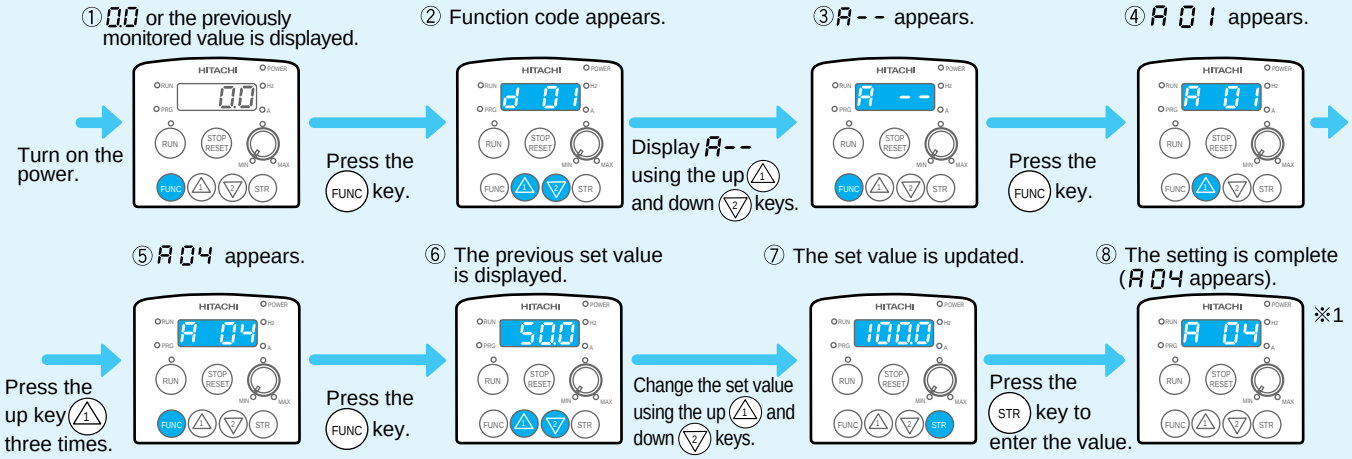
Monitor lamp
Indicates the monitor item.

Frequency setting Potentiometer

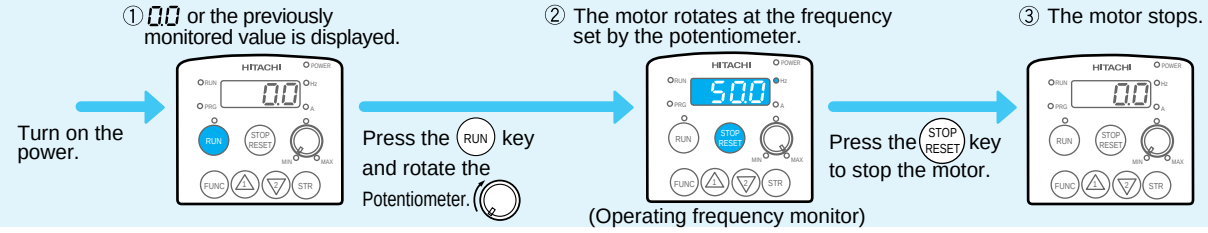
Store key
Use to store the set data.

Up/down keys
Scroll the function code No. or change the setting.

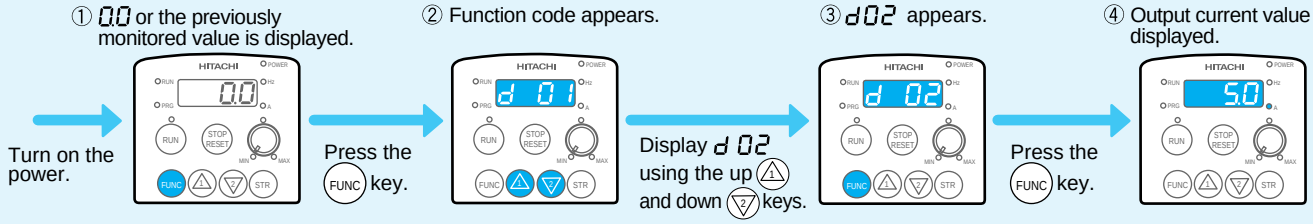
(1) Setting the maximum frequency


① 0.0 or the previously monitored value is displayed.
Turn on the power.
② Function code appears.
Press the FUNC key.
③ A-- appears.
Display A-- using the up and down keys.
④ A 0 1 appears.
Press the FUNC key.
⑤ A 0 4 appears.
Press the up key three times.
⑥ The previous set value is displayed.
Press the FUNC key.
⑦ The set value is updated.
Change the set value using the up and down keys.
⑧ The setting is complete (A 0 4 appears).
Press the STR key to enter the value.
※1

(2) Running the motor (using the Potentiometer)


① 0.0 or the previously monitored value is displayed.
Turn on the power.
② The motor rotates at the frequency set by the potentiometer.
Press the RUN key and rotate the Potentiometer.
(Operating frequency monitor)
③ The motor stops.
Press the STOP RESET key to stop the motor.

(3) Monitoring the output current value


① 0.0 or the previously monitored value is displayed.
Turn on the power.
② Function code appears.
Press the FUNC key.
③ d02 appears.
Display d02 using the up and down keys.
④ Output current value is displayed.
Press the FUNC key.

※ 1 when running the motor, return to Monitor Mode or Basic Setting Mode.

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Function List

"xxE type" and "xxU type" in the tables below refer to the model types for Europe and North America, respectively.

Monitoring Functions and Main Profile Parameters

Code		Function	Monitor/Setting Range	Initial Setting
Monitor	d01	Output frequency monitor	0.0 ~ 360.0 Hz	–
	d02	Output current monitor	0.00 ~ 999.9 A	–
	d03	Running direction monitor	F (forward run) r (reverse run) □ (stop)	–
	d04	Process variable (PV), PID feedback value monitor	0 ~ 9999	–
	d05	Intelligent input terminal status monitor	Display the status of the intelligent terminals (Input, Output)	–
	d06	Intelligent output terminal status monitor		–
	d07	Scaled output freguency monitor	(Output frequency (Hz)) × (frequency converted value b86)	–
	d08	Trip event monitor	–	–
	d09	Trip history monitor	–	–
Setting	F01	Output frequency setting	0.5 ~ 360 Hz	–
	F02	Acceleration time 1 setting	0.1 ~ 3000 s	10.0s
	F202	2ndsetting acceleration time 1 setting	0.1 ~ 3000 s	10.0s
	F03	Deceleration time 1 setting	0.1 ~ 3000 s	10.0 s
	F203	2ndsetting deceleration time 1 setting	0.1 ~ 3000 s	10.0s
	F04	Motor direction setting	00:Forward/01:Reverse	00:Forward
Expanded Function	A--	Extented function of A group setting	A01 ~ A98	–
	B--	Extented function of B group setting	b01 ~ b92	–
	C--	Extented function of C group setting	C01 ~ C95	–
	H--	Extented function of H group setting	H01 ~ H234	–

A Group: Standard Functions

Code		Function	Monitor/Setting Range	Initial Setting
Basic Setting	A01	Frequency Commanding	• Potentiometer (Front Case) • Control terminal • Digital panel	Control terminal
	A02	Run Commanding	• Control terminal • Digital panel	Control terminal
	A03	Base frequency setting	50 ~ 360 Hz	xxE type:50Hz xxU type:60Hz
	A203	2nd setting base frequency setting	50 ~ 360 Hz	xxE type:50Hz xxU type:60Hz
	A04	Maximum frequency setting	50 ~ 360 Hz	xxE type:50Hz xxU type:60Hz
	A204	2nd setting maximun frequency setting	50 ~ 360 Hz	xxE type:50Hz xxU type:60Hz
Analog Input Setting	A11	External frequency setting start	0.0 ~ 360 Hz	0.0 Hz
	A12	External frequency setting end	0.0 ~ 360 Hz	0.0 Hz
	A13	External frequency start rate setting	0 ~ 100%	0%
	A14	External frequency end rate setting	0 ~ 100%	100%
	A15	External frequency start pattern setting	Set frequency of A11 / 0 Hz	0 Hz
	A16	External frequency sampling count setting	1 ~ 8 times	8 times
Multispeed Freq. Setting	A20	Multispeed frequency setting (Speed 0)	0 ~ 360 Hz	0 Hz
	A220	2nd setting multispeed frequency setting (Speed 0)		
	A21 ~ A35	Multispeed frequency setting (Speed 1~ Speed 15)		
	A38	Jogging frequency setting	0.00 ~ 9.99 Hz	1.0 Hz
	A39	Jogging stop operation selection	• Free-run stop • Controlled deceleration • DC braking to stop	Free-run stop

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Code		Function	Setting Range	Initial Setting
V/F Character-istics	A41	Torque boost mode selection	Manual/Auto	Manual
	A241	2nd setting torque boost mode selection	Manual/Auto	Manual
	A42	Manual torque boost setting	0 ~ 99	11
	A242	2nd setting manual torque boost setting	0 ~ 99	11
	A43	Boost frequency setting	0.0 ~ 50.0%	10%
	A243	2nd setting boost frequency setting	0.0 ~ 50.0%	10%
	A44	Control method setting	•Constant torque •Reduced torque •Sensorless vector (*)	Sensorless vector
	A244	2nd setting Control method setting	•Constant torque •Reduced torque •Sensorless vector (*)	Sensorless vector
	A45	Output voltage gain setting	50 ~ 100%	100%
DC Braking	A51	DC braking enable	ON/OFF	OFF
	A52	DC braking frequency setting	0.5 ~ 10Hz	0.5Hz
	A53	DC braking output delay time setting	0.0 ~ 5 s	0.0 s
	A54	DC braking force setting	0 ~ 100%	0%
	A55	DC braking time setting	0.0 ~ 60 s	0.0 s
Upper/Lower Limiter,Jump Frequency	A61	Frequency upper limiter setting	0.0, 0.5 ~ 360(Disable when 0.0) Hz	0.0 Hz
	A62	Frequency lower limiter setting	0.0, 0.5 ~ 360(Disable when 0.0) Hz	0.0 Hz
	A63	Jump frequency setting 1	0.0 ~ 360 Hz	0.0 Hz
	A64	Jump frequency width setting 1	0 ~ 10 Hz	0.5 Hz
	A65	Jump frequency setting 2	0 ~ 360 Hz	0 Hz
	A66	Jump frequency width setting 2	0 ~ 10 Hz	0.5 Hz
	A67	Jump frequency setting 3	0 ~ 360 Hz	0 Hz
	A68	Jump frequency width setting 3	0 ~ 10 Hz	0.5 Hz
PID Control	A71	Enable PID function	ON/OFF	OFF
	A72	P gain setting	0.2 ~ 5 times	1.0
	A73	I gain setting	0.0 ~ 150 s	1.0 s
	A74	D gain setting	0.0 ~ 100 s	0.0 s
	A75	PV scale conversion	0.01 ~ 99.99	1.00
	A76	PV source setting	Current/Voltage	Current
AVR	A81	AVR function selection	ON/OFF/OFF at deceleration	xxE type:OFF at decel xxU type:ON
	A82	AVR voltage selection	200/220/230/240 380/400/415/440/460	xxE type:230/400 xxU type:230/460
2nd Acceleration/ Deceleration Function	A92	Second acceleration time setting	0.1 ~ 3000 s	15.0 s
	A292	2nd setting second acceleration time setting	0.1 ~ 3000 s	15.0 s
	A93	Second deceleration time setting	0.1 ~ 3000 s	15.0 s
	A293	2nd setting second deceleration time setting	0.1 ~ 3000 s	15.0 s
	A94	Second acceleration/deceleration switching method	Terminal /switching frequency	Terminal
	A294	2nd setting second acceleration/deceleration switching method	Terminal /switching frequency	Terminal
	A95	Acceleration switching frequency	0 ~ 360 Hz	0 Hz
	A295	2nd setting acceleration switching frequency	0 ~ 360 Hz	0 Hz
	A96	Deceleration switching frequency	0 ~ 360 Hz	0 Hz
	A296	2nd setting deceleration switching frequency	0 ~ 360 Hz	0 Hz
	A97	Acceleration pattern selection	Linear/S-curve	Linear
	A98	Deceleration pattern selection	Linear/S-curve	Linear

(*) Sensorless vector selected, set carrier frequency more than 2.1kHz by b83

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B Group: Fine Tuning Functions

Code		Function	Setting Range	Initial Setting
Instantaneous Stop Restart	b01	Selection of restart mode	Trip/0Hz start /interrupt start /interrupt stop	Trip
	b02	Allowable instantaneous power failure time setting	0.3 ~ 25 s	1.0 s
	b03	Time and delay enforced before motor restarts	0.3 ~ 100 s	1.0 s
Electronic Thermal	b12	Electronic thermal level setting	50 ~120% of the rated inverter current value | Differs depending on model type	Rated current value
	b212	2nd setting electronic thermal level setting	50 ~120% of the rated inverter current value | Differs depending on model type	Rated current value
	b13	Electronic thermal characteristic selection	Reduced torque /constant torque	Reduced torque characteristic
	b213	2nd setting electronic thermal characteristic selection	Reduced torque /constant torque	Reduced torque characteristic
Overload Limit	b21	Overload restriction operation mode	00 ~ 02 (code)	01:ON only at acceleration and constant speed
	b22	Overload restriction setting	50 ~150% of the rated inverter current value | Differs depending on model type	Rated current x1.25
	b23	Deceleration rate at overload restriction	0.3 ~ 30.0	1.0
Lock	b31	Software lock selection	00 ~ 03 (code)	01
Others	b81	Analog meter adjustment	0 ~ 255	80
	b82	Start frequency adjustment	0.5 ~ 9.9 Hz	0.5 Hz
	b83	Carrier frequency setting	0.5 ~ 16 kHz	5 kHz
	b84	Initialization mode selection	Trip history clear /Parameter initialization	Trip history clear
	b85	Country code for initialization	01, 02	xxE type: 01 xxU type: 02
	b86	Frequency conversion value setting	0.1 ~ 99.9	1.0
	b87	Stop key validity selection during terminal operation	Enabled/disabled	Enabled
	b88	Resume on FRS cancellation mode selection	0Hz start/frequency matching start	0Hz start
	b89	Monitoring selection	01 ~ 07 (code)	01
	b90	Dynaimic braking use time(ratio)setting	00 ~ 100.0	00
	b91	Deceleration mode selection	Deceleration stop/free run stop	Deceleration stop
	b92	FAN ON/OFF selection	ON/OFF at inverter stop	ON

C Group: Intelligent Terminal Functions

Code		Function	Setting Range	Initial Setting
Intelligent Input Terminal Setting	C01	Input terminal 1 setting	Code 00: FW (Forward run) 01: RV (Reverse run) 02: CF1 (Multispeed 1) 03: CF2 (Multispeed 2) 04: CF3 (Multispeed 3) 05: CF4 (Multispeed 4) 06: JG (Jogging operation) 07: DB (External DC braking) 08: SET (2nd setting selection) 09: 2CH (Second acceleration/deceleration command) 11: FRS (Free run stop command) 12: EXT (External trip) 13: USP (Unattended start protection) 15: SFT (Software lock) 16: AT (Analog current input selection signal) 18: RS (Reset) 19: PTC (Thermistor trip)[Assignable to C05 only] 27: UP (Remote control function, Acceleration) 28: DWN (Remote control function, Decceleration)	FW
	C02	Input terminal 2 setting		RV
	C03	Input terminal 3 setting		xxE type:CF1 xxU type:AT
	C04	Input terminal 4 setting		xxE type:CF2 xxU type:USP
	C05	Input terminal 5 setting		xxE type:RS xxU type:2CH
	C06	Input terminal 6 setting		xxE type:2CH xxU type:RS
Intelligent Input Terminal Active State	C11	Input terminal 1 active state	Input terminal active state NO: Normally open NC: Normally closed ●Input ON State 〈NO〉 1~6 P24 〈NC〉 1~6 P24	NO
	C12	Input terminal 2 active state		NO
	C13	Input terminal 3 active state		NO
	C14	Input terminal 4 active state		xxE type:NO xxU type:NC
	C15	Input terminal 5 active state		NO
	C16	Input terminal 6 active state		NO

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Code		Function	Setting Range	Initial Setting
Intelligent Output Terminal Setting	C21	Output terminal 1 setting	Code: 00 RUN (Running signal); 01 FA1 (Frequency arrival signal:command arrival); 02 FA2 (Frequency arrival signal:setting or more); 03 OL (Overload advance notice signal); 04 OD (Output deviation for PID control); 05 AL (Alarm signal)	FA1
	C22	Output terminal 2 setting		RUN
	C23	FM terminal setting	A-F (Analog output frequency monitor) A (Analog output current monitor) D-F (Digital output frequency monitor)	A-F
	C24	Alarm relay output terminal setting	Code: 00 RUN (Running signal); 01 FA1 (Frequency arrival signal:command arrival); 02 FA2 (Frequency arrival signal:setting or more); 03 OL (Overload advance notice signal); 04 OD (Output deviation for PID control); 05 AL (Alarm signal)	AL
Intelligent Output Terminal Active State	C31	Output terminal 11 active state	Output terminal active state NO: Normally open NC: Normally closed	NO
	C32	Output terminal 12 active state	Output terminal active state NO: Normally open NC: Normally closed	NO
	C33	Alarm relay active state	NO: AL0-AL2 is closed at alarm NC: AL0-AL2 opens at alarm	NC
Function Relation with Output Terminal	C41	Overload advance notice signal	0~200% of the inverter rated current / Differs depending on models	Inverter rated current
	C42	Acceleration arrival signal frequency setting	0.0 ~ 360.0 Hz	0 Hz
	C43	Deceleration arrival signal frequency setting	0.0 ~ 360.0 Hz	0 Hz
	C44	PID deviation limit signal level setting	0.0 ~100.0%	3.0%
	C81	Frequency command adjust.(0-L terminal)	0.0 ~255	Factoty set
	C82	Frequency command adjust.(OI-L terminal)	0.0 ~255	Factoty set
Others	C91~C95	—	(Reserved) Do not edit.	—

H Group: Sensorless Vector Functions

Code		Function	Setting Range	Initial Setting
Sensorless Vectol Contorol	H01	Auto-tuning setting	00~02(code)	00
	H02	Motor data	Hitachi standard/auto	Hitachi standard
	H202	Motor data, 2nd motor	Hitachi standard/auto	Hitachi standard
	H03	Motor capacity	0.1~7.5	Factoty set
	H203	Motor capacity, 2nd motor	0.1~7.5	
	H04	Motor poles setting	2 / 4 / 6 / 8	4
	H204	Motor polesetting, 2nd motor	2 / 4 / 6 / 8	4
	H05	Speed control response constant (Kp)	0~99	20
	H205	Speed control response constant (Kp), 2nd motor	0~99	20
	H06	Moter stabilization constant	0~255	100
	H206	Motor stabilization coustant, 2nd motor	0~255	100
Motor Constant	H20	Motor constant R1	0~65.53	Factoty set
	H220	Motor constant R1, 2nd motor	0~65.53	
	H21	Motor constant R2	0~65.53	
	H221	Motor constant R2, 2nd motor	0~65.53	
	H22	Motor constant L	0~655.35	
	H222	Motor constant L, 2nd motor	0~655.35	
	H23	Motor constant Io	0~655.35	
	H223	Motor constant Io, 2nd motor	0~655.35	
	H24	Inertia (J)	0~655.35	
	H224	Inertia (J), 2nd motor	0~655.35	
Auto Tuning Motor Constant	H30	Motor constant R1	0~65.53	
	H230	Motor constant R1, 2nd motor	0~65.53	
	H31	Motor constant R2	0~65.53	
	H231	Motor constant R2, 2nd motor	0~65.53	
	H32	Motor constant L	0~655.35	
	H232	Motor constant L, 2nd motor	0~655.35	
	H33	Motor constant Io	0~655.35	
	H233	Motor constant Io, 2nd motor	0~655.35	
	H34	Inertia (J)	0~655.35	
	H234	Inertia (J), 2nd motor	0~655.35	

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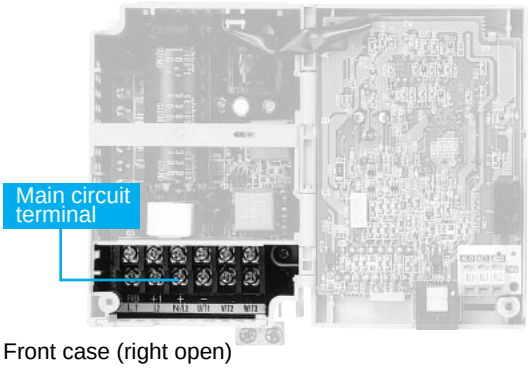
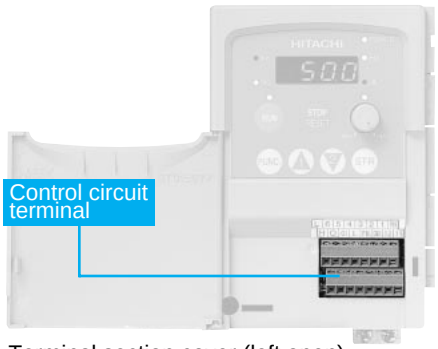
Terminal Functions

[Main Circuit Terminal]



Front case (right open)

[Control Circuit Terminal]



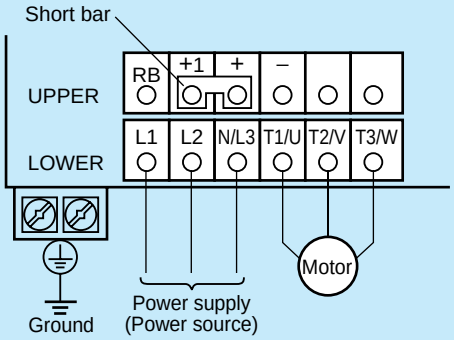
Terminal section cover (left open)

Terminal Screw Diameter

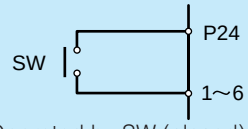
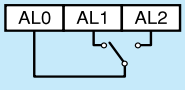
	002~005NFE 002~004NFU	007~022NFE 007~022NFU 037LFU 004~040HFE 004~040HFU	055~075LFU 055~075HFE 055~075HFU
Main circuit terminal	M3.5	M4	M5
Control circuit terminal	M2 (press-tight type)		
Alarm terminal	M3 (press-tight type)		

Main Circuit Terminals

Symbol	Terminal Name	Function
L1,L2,L3	Main power supply input terminals	Connect the input power supply.
T1,T2,T3	Inverter output terminals	Connect the motor.
+, +1	DC reactor connection terminals	Connect the DC reactor for harmonic suppression, power factor improvement.
+, –	External braking unit connection terminals	Connect the optional regenerative braking unit when braking torque required
+, RB	External braking resistor connection terminals	Connect the optional regenerative braking resistor when braking torque required
G ⏚	Ground connection terminal	Ground to prevent electric shock and reduce noise



Control Circuit Terminals

Symbol	Signal	Terminal Name	Remarks
FM	Input/Monitor signal	Monitor terminal (frequency, current, etc.)	PWM output
L		Common terminal for monitor and frequency command	–
P24		Common terminal for the intelligent input terminal	24 VDC
6 5 4 3 2 1		Intelligent input terminals, selection from: Forward run command (FW), Reverse run command (RV), Multispeed commands 1~4 (CF1~CF4), 2-stage acceleration/deceleration command (2CH), Free-run stop (FRS), External trip (EXT), Unattended start protection (USP), Jogging (JG), Analog input selection (AT), Software lock (SFT), Reset (RS), PTC Thermistor thermal protection (PTC), External DC braking (DB), Set second motor (SET), and Remote control acceleration/deceleration(UP/DWN)	Contact input  Operated by SW (closed)
H	Frequency command	Power supply (10VDC) for frequency command	–
O		Frequency command input (voltage command) (0 ~ 10VDC)	Input impedance 10 kΩ
OI		Frequency command input (current command) (4 ~ 20mADC)	Input impedance 250Ω
L		Common terminal for frequency command	–
12 11 CM2	Output signal	Intelligent output terminal, selection from: Run signel (RUN), Freguency arrival at the set freguency signal (FA1), Freguency arrival at or aboue the set freguency signal (FA2), Overload advanced notice signal (OL), Output deviation for PID control (OD), and Alarm signal (AL).	Open collector output L level at operation (ON)
AL2 AL1 AL0	Alarm output	Alarm output terminal: NO-NC contact (relay) output  <Initial Setting> Normal:AL0–AL1 closed Trip/Power OFF:AL0–AL2 closed Common with intelligent output terminal	Contact rating ・AC250V 2.5A (resistor load) 0.2A (cosφ=0.4) ・DC30V 3.0A (resistor load) 0.7A (cosφ=0.4)

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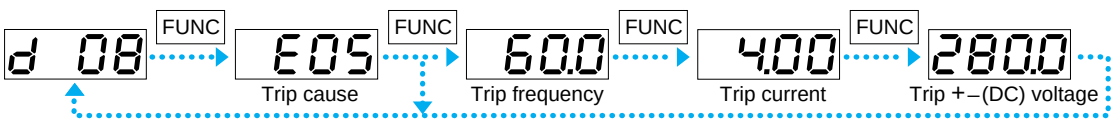
Protective Functions

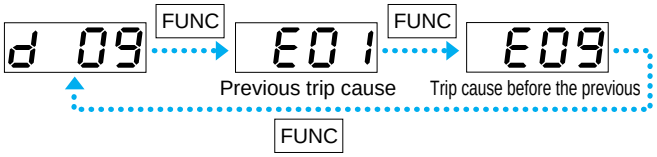
Name	Description		Digital operator	Remote operator /copy unit ERR1 ****
Overcurrent protection	When the motor is restrained or suddenly reduced in speed, a large current is charged to the inverter, causing a fault. When the inverter detects 205% peak current for the rated current of the inverter,Over current is occurred.	Constant speed	E01	OC.Drive
		Deceleration	E02	OC.Decel
		Acceleration	E03	OC.Accel
		Others	E04	Over.c
Overload protection (*1)	When the inverter output current causes the motor to overload, the electronic thermal trip in the inverter cuts off the inverter output.		E05	Over.L
Braking resistor overload protection	If the duty rating for the regenerative braking resistor has been exceeded,an overvoltage is detected by stopping BRD(regenerative braking unit)operation and the inverter output is turned off.		E06	OL.BLD
Overvoltage protection	If regenerative energy from the motor or the main power supply voltage is high, the protective circuit activates to cut off the inverter output when the voltage of the converter section exceeds the specification.		E07	Over.V
EEPROM error(*2)	The inverter output is cut off when EEPROM in the inverter has an error due to external noise, excessive temperature rise, or other factor.		E08	EEPROM
Undervoltage protection	When the input voltage received by the inverter decreases, the control circuit does not function normally. When the input voltage is below the specification, the inverter output is cut off.		E09	Under.V
CT error	Turns off the output if CT in the inverter has become abnormal.		E10	CT
CPU error	The inverter output is cut off when the inverter CPU has a malfunction or an error.		E11 E22	CPU CPU2
External trip	When the external equipment or unit has an error, the inverter receives the corresponding signal and cuts off the output.		E12	EXTERNAL
USP error	The USP error is indicated when the power is turned on with the inverter in RUN state. (Enabled when the USP function is selected.)		E13	USP
Ground fault protection	Ground fault is detected between the inverter output section and the motor when the power is turned on, to protect the inverter.		E14	GND.Flt
Input overvoltage protection	When the input voltage is higher than the specified value, it is detected 100 seconds after power is turned on and the output is cut off.		E15	OV.SRC
Temperature error	When the temperature in the main circuit increases due to cooling fan stop, the inverter output is cut off. (Only for the model type with cooling fan)		E21	OH FIN
PTC error	When the resistance value of the external thermistor is too large, the equipment detects the abnormal condition of the thermistor and then cut off the output (when PTC function is selected)		E35	PTC
Waiting on account of undervoltage	Waiting with the output turned off, because the inverter receiving Voltage has dropped.		_ _U	UV.WAIT

Notes
1.Press the reset key 10 seconds after the alarm has occurred.
2.If an EEPROM error occurs,be sure to comfirm the seting value again.

Trip Monitoring Method



Trip History Monitoring Method



Note
1: [_ _ _] is indicated when there is no trip.

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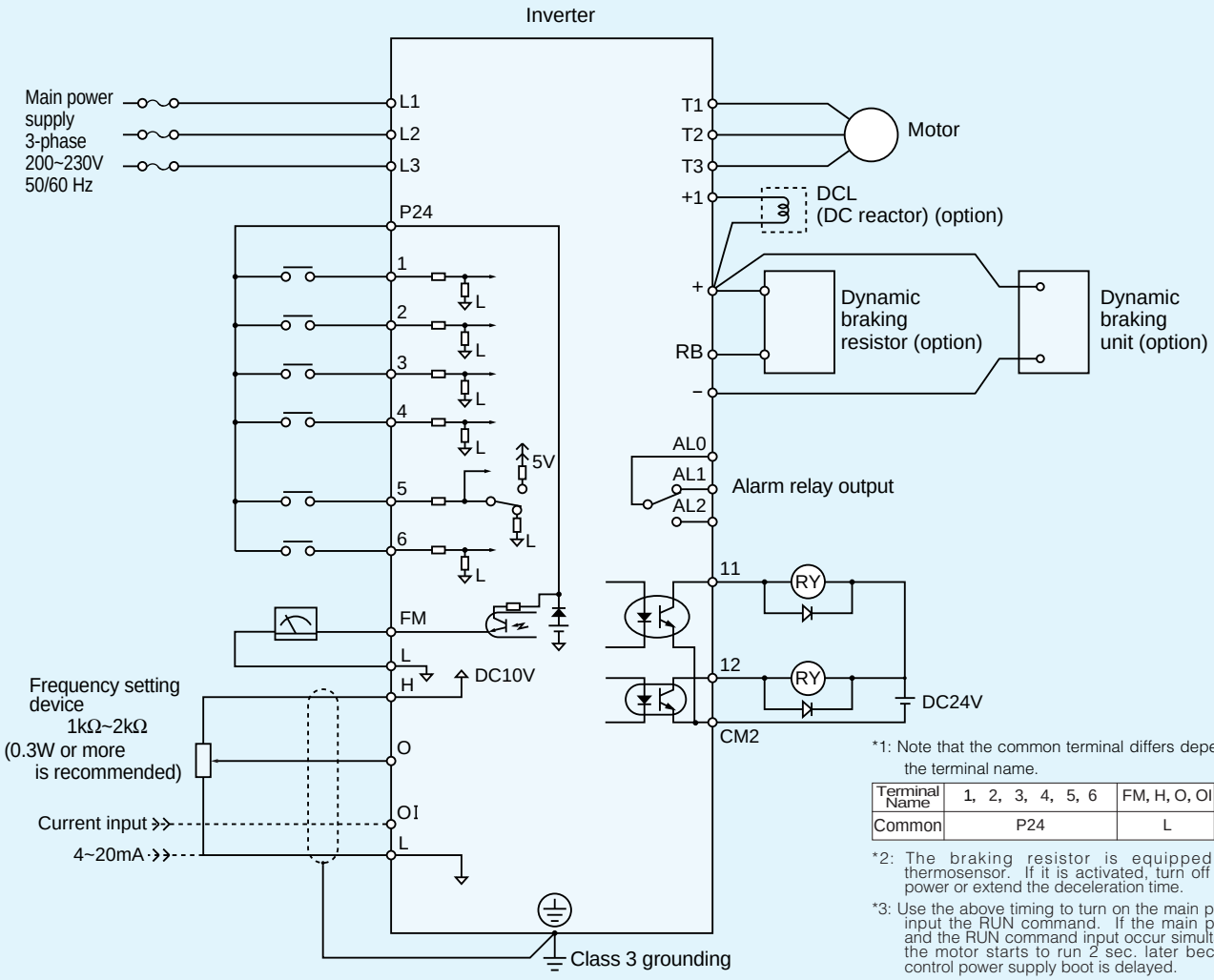
Connection Diagram



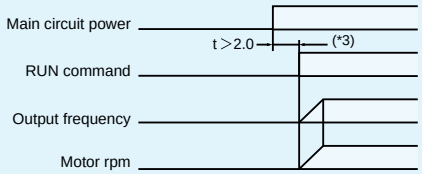
*1: Note that the common terminal differs depending on the terminal name.

Terminal Name	1, 2, 3, 4, 5, 6	FM, H, O, OI	11, 12
Common	P24	L	CM2

*2: The braking resistor is equipped with a thermosensor. If it is activated, turn off the main power or extend the deceleration time.

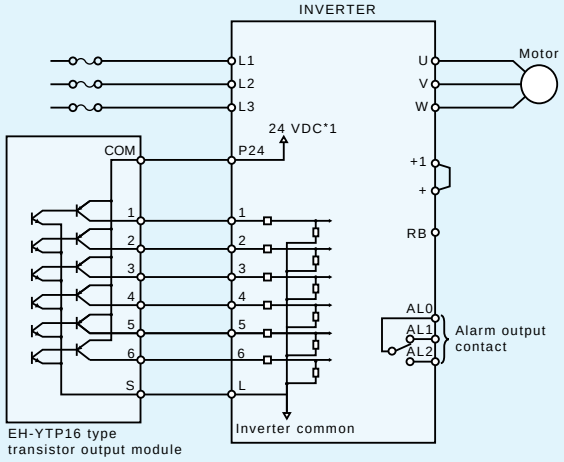
*3: Use the above timing to turn on the main power and input the RUN command. If the main power ON and the RUN command input occur simultaneously, the motor starts to run 2 sec. later because the control power supply boot is delayed.

Turn on the main power at the timing shown below.



<Connection to the Programmable Controller>

When the internal interface power source is used



Note 1:
Do not short circuit the terminals P24 and L by mistake.
The control power supply may cause a failure

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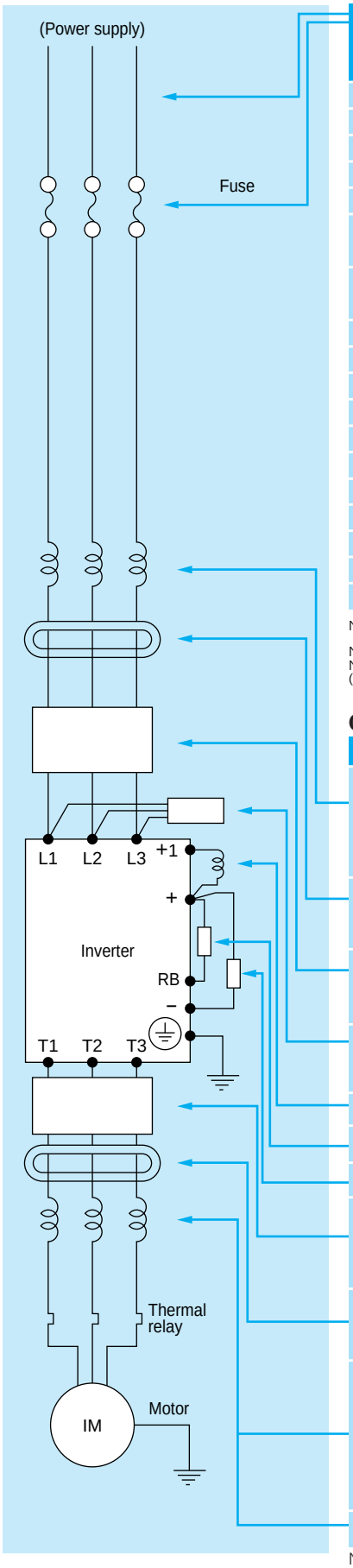
Applicable Wiring Apparatus and Options



Standard Apparatus

Motor Output (kW)	Inverter model	Wiring		Applicable equipment
		Power lines	Signal lines	Fuse(class J) rated 600V
0.2	SJ100-002NFE/NFU	AWG16/1.3mm²	(*) 0.14 to 0.75 mm² Shielded wire	10A
0.4	SJ100-004NFE/NFU			
0.55	SJ100-005NFE			
0.75	SJ100-007NFE/NFU	AWG14/2.1mm²		15A
1.1	SJ100-011NFE			
1.5	SJ100-015NFE/NFU	AWG12/3.3mm²		25A(single ph.) 15A(three ph.)
2.2	SJ100-022NFE/NFU	AWG10/5.3mm²		30A(single ph.) 20A(three ph.)
3.7	SJ100-037LFU	AWG12/3.3mm²		30A
5.5	SJ100-055LFU	AWG10/5.3mm²		40A
7.5	SJ100-075LFU	AWG8/8.4mm²		50A
0.4	SJ100-004HFE/HFU	AWG16/1.3mm²		3A
0.75	SJ100-007HFE/HFU			6A
1.5	SJ100-015HFE/HFU			10A
2.2	SJ100-022HFE/HFU			10A
3.0	SJ100-030HFE	AWG14/2.1mm²		15A
4.0	SJ100-040HFE/HFU			
5.5	SJ100-055HFE/HFU	AWG12/3.3mm²		20A
7.5	SJ100-075HFE/HFU			25A

NOTE1: Field wiring connection must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involeved. Connector must be fixed using the crimp tool specified by the connector manufacturer.
NOTE2: Be sure to consider the capacity of the circuit breaker to be used.
NOTE3: Be sure to use bigger wires for power lines if the distance exceeds 20 m.
(*) Use 0.75 mm² wire for the alarm signal wire.

Options

Name	Function
Input-side AC reactor for harmonicsuppression/power coordination/powerfactor improvement (ALI-□□□2)	This is useful when harmonic suppression measures must be taken, when the main power voltage unbalance rate exceeds 3% and the main power capacity exceeds 500kVA, or when a sudden power voltage variation occurs.It also helps to improve the power factor.
Radio noise filter <zerophase reactor> (ZCL-□)	Noise may occur in a nearby radio, etc., via the mainpower supply side wiring when using the inverter. This filter helps to reduce the noise; radiated noise reduction.
EMI filter for Inverter (FFL100-□□)	Reduces the conductive noise on the main power wires generated from the main power supply. Connect to the inverter primary side (input side).
Input-side radio noise filter (capacitive filter) (CFI-□)	Reduces noise radiated from the main power wiring on the input side.
DC reactor	Suppresses harmonics generated by the inverter.
Braking resistor	This is useful for increasing the control torque of the inverter, for frequently repeating ON-OFF of the inverter, or for decelerating the load with a large inertial moment (GD²).
Braking unit	
Output-side noise filter (ACF-C□)	This is installed between the inverter and the motor to reduce noise radiated from the control power wiring. It is useful for reducing radio-wave disturbance in a radio or TV set and for preventing malfunction of measuring instruments or sensors
Radio noise filter <zero-phase reactor> (ZCL-□□□)	Useful for reducing noise produced in the inverter output side. (It is usable on either the input or output side.)
AC reactor for vibration reduction/thermal relay malfunction prevention (ACL-L2-□□□) (ACL-H2-□□□)	Vibration may increase when driving a general-purpose motor with an inverter as compared with operation on commercial power. Connecting this reactor between the inverter and the motor allows reduction of motor pulsation. When the wiring between the inverter and the motor is 10 m or more, inserting the reactor prevents thermal relay malfunction caused by harmonics resulting from inverter switching. A current sensor can be used instead of the thermal relay.
LCR filter	Output-side sine wave generating filter

Note 1: FFL100 series filter is required for EMC directive(Europe),C-Tick(Australian EMC requirment) but the other options are not for these purpose. Reactors and filters except for EMI filter listed above are for general use in noise reduction.
Note 2: Fieldbus communications -Please consult your sales representative or distributor for available options.

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For Correct Operation

Application to Motors

[Application to general-purpose motors]

Operating frequency	The overspeed endurance of a general-purpose motor is 120% of the rated speed for 2 minutes (JIS C4004). For operation at higher than 60 Hz, it is required to examine the allowable torque of the motor, useful life of bearings, noise, vibration, etc. In this case, be sure to consult the motor manufacturer as the maximum allowable rpm differs depending on the motor capacity, etc.
Torque characteristics	The torque characteristics of driving a general-purpose motor with an inverter differ from those of driving it with commercial power (starting torque decreases in particular). Carefully check the load torque characteristic of a connected machine and the driving torque characteristic of the motor.
Motor loss and temperature increase	An inverter-driven general-purpose motor heats up swiftly at lower speeds. Consequently, the torque level permitting continuous use decreases with lower motor speeds. Carefully check the torque characteristics.
Noise	When run by an inverter, a general-purpose motor generates noise slightly greater than with commercial power.
Vibration	When run by an inverter at variable speeds, the motor may generate vibration, especially because of (a) unbalance of the rotor including a connected machine, or (b) resonance caused by the natural vibration frequency of a mechanical system. Particularly, be careful of (b) when operating at variable speeds a machine previously fitted with a constant speed motor. Vibration can be minimized by (1) avoiding resonance points using the frequency jump function of the inverter, (2) using a tire-shaped coupling, or (3) placing a rubber shock absorber beneath the motor base.
Power transmission mechanism	Under continued, low-speed operation, oil lubrication can deteriorate in a power transmission mechanism with an oil-type gear box (gear motor) or reducer. Check with the motor manufacturer for the permissible range of continuous speed. To operate at more than 60 Hz, confirm the machine's ability to withstand the centrifugal force generated.

[Application to special motors]

Gear motor	The allowable rotation range of continuous drive varies depending on the lubrication method or motor manufacturer. (Particularly in case of oil lubrication, pay attention to the low frequency range.) The Hitachi CX/CA gear motors are of a grease lubrication type. Their grease lubrication capability remains unchanged even if the motor rotating speed decreases.
Brake-equipped motor	For use of a brake-equipped motor, be sure to connect the braking power supply from the primary side of the inverter.
Pole-change motor	There are different kinds of pole-change motors, constant output characteristic type, constant torque characteristic type, etc., and with different rated current values. In motor selection, check the maximum allowable current for each motor of a different pole count. At the time of pole changing, be sure to stop the motor.
Submersible motor	The rated current of a submersible motor is significantly larger than that of the general-purpose motor. In inverter selection, be sure to check the rated current of the motor.
Explosion-proof motor	Inverter drive is not suitable for a safety-enhanced explosion-proof type of motor. The inverter should be used in combination with a pressure-proof explosion-proof type of motor. * Explosion-proof verification is not available for SJ100 Series. For explosion-proof operation, use other series of motors.
Synchronous (MS) motor High-speed (HFM) motor	In most cases, the synchronous (MS) motor and the high-speed (HFM) motor are designed and manufactured to meet the specifications suitable for a connected machine. As to inverter selection, consult the manufacturer.
Single-phase motor	A single-phase motor is not suitable for variable-speed operation by inverter drive. Therefore, use a three-phase motor.

[Application to the 400V-class motor]

A system applying a voltage-type PWM inverter with IGBT may have surge voltage at the motor terminals resulting from the cable constants including the cable length and the cable laying method. Depending on the surge current magnification, the motor coil insulation may be degraded. In particular, when a 400V-class motor is used, a longer cable is used, and critical loss can occur, take the following countermeasures:
(1) install the LCR filter between the inverter and the motor,
(2) install the AC reactor between the inverter and the motor, or
(3) enhance the insulation of the motor coil.

Notes on Use

[Drive]

Run/Stop	Run or stop of the inverter must be done with the keys on the operator panel or through a control circuit terminal. Do not operate by installing a electromagnetic contactor (Mg) in the main circuit.
Emergency motor stop	When the protective function is operating or the power supply stops, the motor enters the free run stop state. When an emergency stop is required or when the motor should be kept stopped, use the mechanical brake.
High-frequency run	A max. 360 Hz can be selected on the SJ100 Series. However, a two-pole motor can attain up to approx. 21,600 rpm, which is extremely dangerous. Therefore, carefully make selection and settings by checking the mechanical strength of the motor and connected machines. Consult the motor manufacturer when it is necessary to drive a standard (general-purpose) motor at over 60 Hz. A full line of high-speed motors is available from Hitachi.

[Installation location and operating environment]

Avoid installation in areas of high temperature, excessive humidity, or where moisture can easily collect, as well as areas that are dusty, subject to corrosive gasses, mist of liquid for grinding, or salt. Install the inverter away from direct sunlight in a well-ventilated room that is free of vibration. The inverter can be operated in the ambient temperature range from -10 to 50°C.(carrier frequency and output current must be reduced in the range of 40 to 50°C)

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[Main power supply]

Installation of an AC reactor on the input side	In the cases below involving a general-purpose inverter, a large peak current flows on the main power supply side, and is able to destroy the converter module. Where such situations are foreseen or the connected equipment must be highly reliable, install an AC reactor between the power supply and the inverter. Also, where influence of indirect lightning strike is possible, install a lightning conductor. (A) The unbalance factor of the power supply is 3% or higher. (Note) (B) The power supply capacity is at least 10 times greater than the inverter capacity (the power supply capacity is 500 kVA or more). (C) Abrupt power supply changes are expected. Examples: (1) Several inverters are interconnected with a short bus. (2) A thyristor converter and an inverter are interconnected with a short bus. (3) An installed phase advance capacitor opens and closes. In cases (A), (B) and (C), it is recommended to install an AC reactor on the main power supply side. Note: Example calculation with V_{RS} = 200V, V_{ST} = 203V, V_{TR} = 197V V_{RS} : R-S line voltage, V_{ST} : S-T line voltage, V_{TR} : T-R line voltage Unbalance factor of voltage $= \frac{\text{Max. line voltage (min.) - Mean line voltage}}{\text{Mean line voltage}} \times 100$ $= \frac{V_{RS} - (V_{RS} + V_{ST} + V_{TR})/3}{(V_{RS} + V_{ST} + V_{TR})/3} \times 100 = \frac{205 - 202}{202} \times 100 = 1.5\ (\%)$
Using a private power generator	An inverter run by a private power generator may overheat the generator or suffer from a deformed output voltage waveform of the generator. Generally, the generator capacity should be five times that of the inverter (kVA) in a PWM control system, or six times greater in a PAM control system.

Notes on Peripheral Equipment Selection

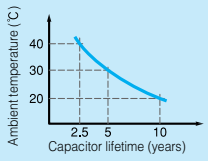
Wiring connections		(1) Be sure to connect main power wires with R, S, and T (input) terminals and motor wires to U, V, and W terminals (output). (Incorrect connection will cause a breakdown.) (2) Be sure to provide a grounding connection with the ground terminal (⏚).
Wiring between inverter and motor	Electro-magnetic contactor	When an electromagnetic contactor is installed between the inverter and the motor, do not perform on-off switching during running operation.
	Thermal relay	When used with standard applicable output motors (Hitachi standard three-phase squirrel-cage four-pole motors), the SJ100 Series do not need a thermal relay for motor protection due to the internal electronic protective circuit. A thermal relay, however, should be used: • during continuous running at a range beyond 30 to 60 Hz. • for motors exceeding the range of electronic thermal adjustment (rated current). • when several motors are driven by the same inverter; install a thermal relay for each motor. • The RC value of the thermal relay should be more than 1.1 times the rated current of the motor. Where the wiring length is 10 m or more, the thermal relay tends to turn off readily. In this case, provide an AC reactor on the output side or use a current sensor. See the item for the thermal relay malfunction preventive AC reactor on page 16.
Installing a circuit breaker		Install a circuit breaker on the main power input side to protect inverter wiring and ensure personal safety. Choose an inverter-compatible circuit breaker. The conventional type may malfunction due to harmonics from the inverter. For more information, consult the circuit breaker manufacturer.
Wiring distance		The wiring distance between the inverter and the remote operator panel should be 20 meters or less. When this distance is exceeded, use CVD-E (current-voltage converter) or RCD-E (remote control device). Shielded cable should be used on the wiring. Beware of voltage drops on main circuit wires. (A large voltage drop reduces torque.)
Earth leakage relay		If the earth leakage relay (or earth leakage breaker) is used, it should have a sensitivity level of 15 mA or more (per inverter). The leakage current differs depending on the cable length; see page xx.
Phase advance capacitor		Do not use a capacitor for power factor improvement between the inverter and the motor because the high-frequency components of the inverter output may overheat or damage the capacitor

High-frequency Noise and Leakage Current

(1) High-frequency components are included in the input/output of the inverter main circuit, and they may cause interference in a transmitter, radio, or sensor if used near the inverter. The interference can be minimized by attaching noise filters (option) in the inverter circuitry.
(2) The switching action of an inverter causes an increase in leakage current. Be sure to ground the inverter and the motor.

Lifetime of Primary Parts

Because a smoothing capacitor deteriorates as it undergoes internal chemical reaction, it should normally be replaced every five years. Be aware, however, that its life expectancy is considerably shorter when the inverter is subjected to such adverse factors as high temperatures or heavy loads exceeding the rated current of the inverter.
The approximate lifetime of the capacitor is as shown in the figure at the right when it is used 12 hours daily (according to the "Instructions for Periodic Inspection of General-Purpose Inverter" (JEMA).)
Also, such consumable parts as a cooling fan should be replaced. (Maintenance inspection and parts replacement must be performed by only specified trained personnel.)



Precaution for Correct Usage

- Before use, be sure to read through the Instruction Manual to insure proper use of the inverter.
- Note that the inverter requires electrical wiring; a specialist should carry out the wiring.
- The inverter in this catalog is designed for general industrial applications. For special applications in fields such as aircraft, outer space, nuclear power, electrical power, transport vehicles, clinics, and submarine relay equipment, please consult with us in advance.
- For application in a facility where human life is involved or serious losses may occur, make sure to provide safety devices to avoid a serious accident.
- The inverter is intended for use with a three-phase AC motor. For use with a load other than this, please consult with us.

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